

S/N 09/945,535



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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|-------------|--|-----------------|---------------|
| Applicant: | Kie Y. Ahn et al. | Examiner: | David S. Blum |
| Serial No.: | 09/945,535 | Group Art Unit: | 2813 |
| Filed: | August 30, 2001 | Docket: | 1303.026US1 |
| Title: | HIGHLY RELIABLE AMORPHOUS HIGH-K GATE OXIDE ZrO ₂ | | |

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicants respectfully request that this Supplemental Information Disclosure Statement be entered and the documents listed on the attached Form 1449 be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicants request that a copy of the 1449 form, initialed as being considered by the Examiner, be returned to the Applicants with the next official communication.

Pursuant to 37 C.F.R. §1.97(c)(2), Applicants have included the fee of \$180.00 as set forth in 37 C.F.R. §1.17(p). Please charge any additional fees or credit any overpayment to Deposit Account No. 19-0743.

06/15/2005 AAD0F01 00000030 09945535

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180.00 DP

The Examiner is invited to contact the Applicants' Representative at the below-listed telephone number if there are any questions regarding this communication.

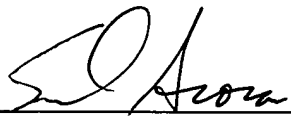
Pursuant to 37 C.F.R. 1.98(a)(2), Applicant believes that copies of cited U.S. Patents and Published Applications are no longer required to be provided to the Office. Notification of this change was provided in the United States Patent and Trademark Office OG Notices dated October 12, 2004. Thus, Applicant has not included copies of any US Patents or Published Applications cited with this submission. Should the Office require copies to be provided, Applicant respectfully requests that notice of such requirement be directed to Applicant's below-signed representative. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R. 1.98(a)(2).

Respectfully submitted,

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Date June 7, 2005 By 
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Reg. No. 42,267

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: MS Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 7 day of June, 2005.

Name KACIA LEE


Signature

Substitute for form 1449A/PTO
**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Use as many sheets as necessary)



Complete if Known

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|----------------------|-----------------|
| Application Number | 09/945,535 |
| Filing Date | August 30, 2001 |
| First Named Inventor | Ahn, Kie |
| Group Art Unit | 2813 |
| Examiner Name | Blum, David |

Sheet 1 of 3

Attorney Docket No: 1303.026US1

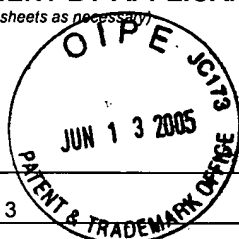
US PATENT DOCUMENTS

| Examiner Initial * | USP Document Number | Publication Date | Name of Patentee or Applicant of cited Document | Filing Date If Appropriate |
|--------------------|---------------------|------------------|---|----------------------------|
| | US-2001/0030352-A1 | 10/18/2001 | Ruff, Alexander , et al. | 02/28/2001 |
| | US-2002/0111001-A1 | 08/15/2002 | Ahn, Kie Y. | 02/09/2001 |
| | US-2002/0155688-A1 | 10/24/2002 | Ahn, Kie Y. | 04/20/2001 |
| | US-2002/0155689-A1 | 10/24/2002 | Ahn, Kie Y. | 02/11/2002 |
| | US-2002/0192975-A1 | 12/19/2002 | Ahn, Kie Y. | 06/17/2002 |
| | US-2002/0192979-A1 | 12/19/2002 | Ahn, Kie Y. | 06/17/2002 |
| | US-2003/0003702-A1 | 01/02/2003 | Ahn, Kie Y. | 08/26/2002 |
| | US-2003/0017717-A1 | 01/23/2003 | Ahn, Kie Y. | 07/18/2001 |
| | US-2003/0043637-A1 | 03/06/2003 | Forbes, Leonard , et al. | 08/30/2001 |
| | US-2003/0045060-A1 | 03/06/2003 | Ahn, Kie Y. | 08/30/2001 |
| | US-2003/0049942-A1 | 03/13/2003 | Haukka, S. , et al. | 08/22/2002 |
| | US-2003/0119246-A1 | 06/26/2003 | Ahn, Kie Y. | 12/20/2001 |
| | US-2003/0119291-A1 | 06/26/2003 | Ahn, Kie Y., et al. | 12/20/2001 |
| | US-2003/0132491-A1 | 07/17/2003 | Ahn, Kie Y. | 01/17/2002 |
| | US-2003/0185980-A1 | 10/02/2003 | Endo, K. | 03/31/2003 |
| | US-2003/0207032-A1 | 11/06/2003 | Ahn, Kie Y., et al. | 05/02/2002 |
| | US-2003/0207540-A1 | 11/06/2003 | Ahn, Kie Y., et al. | 05/02/2002 |
| | US-2003/0227033-A1 | 12/11/2003 | Ahn, Kie Y., et al. | 06/05/2002 |
| | US-2004/0007171-A1 | 01/15/2004 | Ritala, Mikko , et al. | 07/10/2003 |
| | US-2004/0009679-A1 | 01/15/2004 | Yeo, J. , et al. | 07/10/2003 |
| | US-2004/0023461-A1 | 02/05/2004 | Ahn, Kie Y., et al. | 07/30/2002 |
| | US-2004/0033661-A1 | 02/19/2004 | Yeo, J. , et al. | 06/02/2003 |
| | US-2004/0038554-A1 | 02/26/2004 | Ahn, Kie Y. | 08/21/2002 |
| | US-2004/0043541-A1 | 03/04/2004 | Ahn, Kie Y. | 08/29/2002 |
| | US-2004/0043569-A1 | 03/04/2004 | Ahn, Kie Y. | 08/28/2002 |
| | US-2004/0110348-A1 | 06/10/2004 | Ahn, Kie Y., et al. | 12/04/2002 |
| | US-2004/0110391-A1 | 06/10/2004 | Ahn, K. Y., et al. | 12/04/2002 |
| | US-2004/0134365-A1 | 08/26/2004 | Ahn, Kie Y., et al. | 02/27/2004 |
| | US-2004/0144980-A1 | 07/29/2004 | Ahn, Kie Y., et al. | 01/29/2003 |
| | US-2004/0164357-A1 | 08/26/2004 | Ahn, Kie Y., et al. | 02/27/2004 |
| | US-2004/0168627-A1 | 09/02/2004 | Conley, Jr., J. F., et al. | 02/27/2003 |
| | US-2004/0171280-A1 | 09/02/2004 | Conley, Jr., J. F., et al. | 02/27/2003 |
| | US-2004/0175882-A1 | 09/09/2004 | Ahn, Kie Y., et al. | 03/04/2003 |
| | US-2004/0183108-A1 | 09/23/2004 | Ahn, Kie Y. | 01/27/2004 |
| | US-2004/0185654-A1 | 09/23/2004 | Ahn, Kie Y. | 01/30/2004 |
| | US-2004/0203254-A1 | 10/14/2004 | Conley, Jr., J. F., et al. | 04/11/2003 |
| | US-2004/0235313-A1 | 11/25/2004 | Frank, M. M., et al. | 06/24/2004 |
| | US-2004/0266217-A1 | 12/30/2004 | Kim, K. , et al. | 06/23/2004 |
| | US-2005/0009370-A1 | 01/13/2005 | Ahn, Kie Y. | 08/04/2004 |
| | US-2005/0023578-A1 | 02/03/2005 | Bhattacharyya, A. | 08/25/2004 |

EXAMINER

DATE CONSIDERED

Substitute for form 1449A/PTO
**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Use as many sheets as necessary)



Complete if Known

Application Number 09/945,535
Filing Date August 30, 2001
First Named Inventor Ahn, Kie
Group Art Unit 2813
Examiner Name Blum, David

Sheet 2 of 3

Attorney Docket No: 1303.026US1

| | | | |
|--------------------|------------|-------------------------------|------------|
| US-2005/0023594-A1 | 02/03/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0023613-A1 | 02/03/2005 | Bhattacharyya, A. | 08/25/2004 |
| US-2005/0023624-A1 | 02/03/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0023625-A1 | 02/03/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0023626-A1 | 02/03/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0023627-A1 | 02/03/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0026374-A1 | 02/03/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0029547-A1 | 02/10/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0029604-A1 | 02/21/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0029605-A1 | 02/10/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0032292-A1 | 02/10/2005 | Ahn, K. Y., et al. | 08/31/2004 |
| US-2005/0037563-A1 | 02/17/2005 | Ahn, Kie Y. | 08/31/2004 |
| US-2005/0051828-A1 | 03/10/2005 | Park, K., et al. | 04/21/2004 |
| US-2005/0054165-A1 | 03/10/2005 | Ahn, K. Y., et al. | 03/31/2003 |
| US-2005/0077519-A1 | 04/14/2005 | Ahn, Kie, et al. | 10/10/2003 |
| US-5,562,952 | 10/08/1996 | Nakahigashi, Takahiro, et al. | 04/04/1995 |
| US-5,646,583 | 07/08/1997 | Seabury, C. W., et al. | 01/04/1996 |
| US-5,674,563 | 10/07/1997 | Tarui, Yasuo, et al. | 09/14/1994 |
| US-5,751,021 | 05/12/1998 | Teraguchi, Nobuaki | 04/22/1996 |
| US-5,827,571 | 10/27/1998 | Lee, Seung S., et al. | 09/17/1997 |
| US-6,632,279 | 10/14/2003 | Ritala, M., et al. | 10/13/2000 |
| US-6,686,212 | 02/03/2004 | Conley, Jr., J. F., et al. | 10/31/2002 |
| US-6,699,747 | 03/02/2004 | Ruff, Alexander, et al. | 11/18/2002 |
| US-6,709,989 | 03/23/2004 | Ramdani, J., et al. | 06/21/2001 |
| US-6,777,353 | 08/17/2004 | Putkonen, M. | 04/08/2003 |
| US-6,787,413 | 09/07/2004 | Ahn, Kie Y. | 06/17/2002 |
| US-6,790,791 | 09/14/2004 | Ahn, Kie Y., et al. | 08/15/2002 |
| US-6,812,100 | 11/02/2004 | Ahn, K. Y., et al. | 03/13/2002 |
| US-6,828,632 | 12/07/2004 | Bhattacharyya, A. | 07/18/2002 |
| US-6,884,739 | 04/26/2005 | Ahn, K. Y., et al. | 08/15/2002 |
| US-6,893,984 | 05/17/2005 | Ahn, K. Y., et al. | 02/20/2002 |
| US-6,900,122 | 05/31/2005 | Ahn, K. Y., et al. | 12/20/2001 |

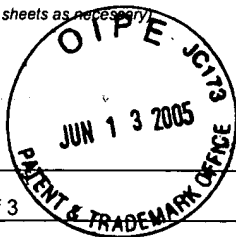
FOREIGN PATENT DOCUMENTS

| Examiner Initials* | Foreign Document No | Publication Date | Name of Patentee or Applicant of cited Document | T ² |
|--------------------|---------------------|------------------|---|----------------|
| | WO-04079796A3 | 09/16/2004 | Ahn, K. Y., et al. | |

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DATE CONSIDERED

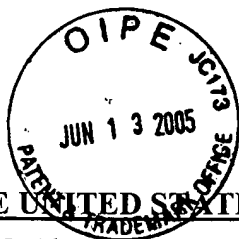
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| Substitute for form 1449A/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i> | Complete if Known | |
| | Application Number | 09/945,535 |
| | Filing Date | August 30, 2001 |
| | First Named Inventor | Ahn, Kie |
| | Group Art Unit | 2813 |
| | Examiner Name | Blum, David |
| Sheet 3 of 3 | Attorney Docket No: 1303.026US1 | |



| OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS | | | |
|--|----------------------|---|----------------|
| Examiner Initials* | Cite No ¹ | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T ² |
| | | CHIN, A. , et al., "High Quality La2O3 and Al2O3 Gate Dielectrics with Equivalent Oxide Thickness 5-10A", <u>Digest of Technical Papers, 2000 Symposium on VLSI Technology, 2000, Honolulu, (June 13-15, 2000), 16-17</u> | |
| | | COPEL, M. , et al., "Formation of a stratified lanthanum silicate dielectric by reaction with Si(001)", <u>Applied Physics Letters, 78(11), (March 12, 2001), 1607-1609</u> | |
| | | DIMOULAS, A. , et al., "Structural and electrical quality of the high-k dielectric Y2O3 on Si (001): Dependence on growth parameters", <u>Journal of Applied Physics, 92(1), (July 1, 2002), 426-431</u> | |
| | | GUHA, S , et al., "Atomic beam deposition of lanthanum-and yttrium-based oxide thin films for gate dielectrics", <u>Applied Physics Letters, 77, (2000), 2710-2712</u> | |
| | | GUHA, S. , et al., "High temperature stability of Al2O3 dielectrics on Si: Interfacial metal diffusion and mobility degradation", <u>Applied Physics Letters, Vol. 81, No. 16, (14 October 2002), 2956-2958</u> | |
| | | HUANG, C. H., et al., "La/sub 2O/sub 3//Si/sub 0.3/Ge/sub 0.7/ p-MOSFETs with high hole mobility and good device characteristics", <u>IEEE Electron Device Letters, 23(12), (December 2002), 710-712</u> | |
| | | IWAI, H. , et al., "Advanced gate dielectric materials for sub-100 nm CMOS", <u>International Electron Devices Meeting, 2002. IEDM '02. Digest., (December 8-11, 2002), 625-628</u> | |
| | | KO, MYOUNG-GYUN , et al., "High density plasma enhanced atomic layer deposition of lanthanum oxide for high-k gate oxide material", <u>207th Meeting of the Electrochemical Society, (May 2005), 1 page</u> | |
| | | MARIA, J. P., et al., "High temperature stability in lanthanum and zirconia-based gate dielectrics", <u>Journal of Applied Physics, 90(7), (October 1, 2001), 3476-3482</u> | |
| | | MICHAELSON, HERBERT B., "The work function of the elements and its periodicity", <u>Journal of Applied Physics, 48(11), (November 1977), 4729-4733</u> | |
| | | SHIMIZU, TAKASHI , et al., "Electrical Properties of Ruthenium/Metalorganic Chemical Vapor Deposited La-Oxide/Si Field Effect Transistors", <u>Jpn. J. Appl. Phys., Vol. 42, Part 2, No. 11A, (2003), L1315-L1317</u> | |
| | | YAMADA, HIROTOSHI , et al., "MOCVD of High-Dielectric-Constant Lanthanum Oxide Thin Films", <u>Journal of The Electrochemical Society, 150(8), (August 2003), G429-G435</u> | |
| | | ZHONG, HUICAI , et al., "Electrical Properties of Ru and RuO2 Gate Electrodes for Si-PMOSFET with ZrO2 and Zr-Silicate Dielectrics", <u>Journal of Electronic Materials, 30(12), (December 2001), 1493</u> | |

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DATE CONSIDERED



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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Kie Y. Ahn et al.

Examiner: David S. Blum

Serial No.: 09/945,535

Group Art Unit: 2813

Filed: August 30, 2001

Docket: 1303.026US1

Title: HIGHLY RELIABLE AMORPHOUS HIGH-K GATE OXIDE ZRO2

COMMUNICATION CONCERNING RELATED APPLICATION(S)

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Applicants would like to bring to the Examiner's attention the following related application(s) in the above-identified patent application:

| <u>Serial/Patent No.</u> | <u>Filing Date</u> | <u>Attorney Docket</u> | <u>Title</u> |
|--------------------------|--------------------|------------------------|--|
| 10/909959 | August 2, 2004 | 1303.114US1 | ATOMIC LAYER DEPOSITION OF ZIRCONIUM-DOPED TANTALUM OXIDE FILMS |
| 10/931533 | August 31, 2004 | 1303.119US1 | ATOMIC LAYER DEPOSITED TITANIUM ALUMINUM OXIDE FILMS |
| 10/926812 | August 26, 2004 | 1303.121US1 | RUTHENIUM GATE FOR A LANTHANIDE OXIDE DIELECTRIC LAYER |
| 10/930167 | August 31, 2004 | 1303.122US1 | ATOMIC LAYER DEPOSITED LANTHANUM ALUMINUM OXIDE DIELECTRIC LAYER |
| 11/010529 | December 13, 2004 | 1303.126US1 | ATOMIC LAYER DEPOSITED LANTHANUM HAFNIUM OXIDE DIELECTRICS |
| 11/029757 | January 5, 2005 | 1303.127US1 | ATOMIC LAYER DEPOSITED HAFNIUM TANTALUM OXIDE DIELECTRICS |
| 11/010766 | December 13, 2004 | 1303.129US1 | HYBRID ALD-CVD OF PrXOY/ZrO2 FILMS AS GATE DIELECTRICS |
| 11/058563 | February 15, 2005 | 1303.133US1 | ATOMIC LAYER DEPOSITION OF Zr3N4/ZrO2 FILMS AS GATE DIELECTRICS |

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|-----------|----------------------|-------------|--|
| 11/063717 | February 23, 2005 | 1303.134US1 | ATOMIC LAYER DEPOSITION OF Hf3N4/HfO2 FILMS AS GATE DIELECTRICS |
| 11/059594 | February 16, 2005 | 1303.046US2 | EVAPORATED LaAlO3 FILMS FOR GATE DIELECTRICS |
| 11/092072 | March 29, 2005 | 1303.135US1 | ALD OF AMORPHOUS LANTHANIDE DOPED TIOX FILMS |
| 11/093104 | March 29, 2005 | 1303.136US1 | ATOMIC LAYER DEPOSITED TITANIUM SILICON OXIDE FILMS |
| 11/117121 | April 28, 2005 | 1303.138US1 | ATOMIC LAYER DEPOSITED ZIRCONIUM SILICON OXIDE FILMS |
| 11/117125 | April 28, 2005 | 1303.139US1 | ATOMIC LAYER DEPOSITION OF A RUTHENIUM LAYER TO A LANTHANIDE OXIDE DIELECTRIC LAYER |
| 11/084968 | March 21, 2005 | 1303.083US2 | Zr-Sn-Ti-O FILMS |

Continuations and divisionals may be later filed on the cases listed above, or cited to the Examiner in any previous Communication Concerning Related Applications. Applicant requests that the Examiner review all continuations and divisionals of the above-listed or previously-cited patent applications before allowing the claims of the present patent application.

Respectfully submitted,
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Date June 7, 2005

By


Suneel Arora

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 7 day of June, 2005.

Name

KACIA LEE

Signature

Kacia Lee